

ATMOSPHERIC ELECTRICITY.

GENERAL STATISTICS.

The table showing in detail for October, 1894, the statistics relative to auroras and thunderstorms is placed among the meteorological tables as No. XI, instead of being given in the text as heretofore. It shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month.

THUNDERSTORMS.

A mention of the more severe thunderstorms reported during the month is given under "Local storms." The dates on which reports of thunderstorms were most numerous were: 3d, 50; 13th, 48; 20th, 83; 21st, 61; 25th, 68.

The States where thunderstorm reports were most numerous were: Missouri, Minnesota, Ohio, Wisconsin, Oregon, Illinois, and Iowa.

The States where the dates of thunderstorms were most frequent were: Missouri, where they were recorded on eighteen days; Ohio, seventeen days; Minnesota and Wisconsin, fourteen days.

DAMAGE BY LIGHTNING.

The following statistics of the damage done by lightning in October, so far as reported by the observers of this Bureau, are furnished by Mr. Alexander McAdie:

During October, 1894, 7 persons were killed and 2 severely

injured; 2 barns, 2 dwellings, 3 churches, and 2 car stables burned.

AURORAS.

The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four days preceding and following the date of full moon, viz, from the 10th to the 18th, inclusive. On the remaining twenty-two days of this month 103 reports were received, or an average of 5 per day. The dates on which the reported number especially exceeded this average were: 25th, 21; 27th, 11; 29th, 8. The States from which auroras were reported by a large percentage of observers were: North Dakota and Delaware.

The States where the dates of auroras were most frequent were: North Dakota, 16; Minnesota, 11.

CANADIAN DATA—THUNDERSTORMS AND AURORAS.

Thunderstorms were reported as follows: 3d, Toronto, Ont. 4th and 5th, Port Stanley, Ont. 17th, Grindstone, Gulf of St. L., Charlottetown, P. E. I., and Grand Manan, N. B. 20th, Port Stanley, Ont. 23d, Quebec, Que.

Auroras were reported as follows: 2d, Quebec, Que., and St. Andrews, N. B. 5th, St. Andrews, N. B. 17th, Port Arthur, Ont. 20th and 22d, Father Point, Que. 29th, Quebec and Father Point, Que. 30th, Grindstone, Gulf of St. L., Father Point, Que., St. Andrews, N. B., and Charlottetown, P. E. I.

METEOROLOGY AND MAGNETISM.

The movements of our atmosphere are to be studied primarily as problems in the mechanics and thermodynamics of moving gases and vapors, but our knowledge of the empirical relations between atmospheric phenomena and those of terrestrial magnetism has been elucidated by a few special students, and further study in this direction has been recognized by the Chief of the Weather Bureau as proper and desirable. In accordance with the views that have been frequently explained by Professor Bigelow as to the action of the sun upon the earth there are two classes of influence that emanate from the sun, i. e., (1) a direct flow of energy that is known to us as sunshine and radiant energy; (2) an indirect flow that proceeds from the sun in curved lines which are called coronal beams when seen during a solar eclipse, or auroral beams when seen during an aurora, or magnetic curves when revealed by the disturbances of the magnetic needle. The coronal curves are normals to the so-called equipotential surfaces, and have the same form whether the phenomenon is one of fluid motion or of electric influence. In order to avoid any appearance of undue partiality to any theory, Professor Bigelow calls these lines the coronal field, because they were first studied in the photographs of solar eclipses. Those studies showed that the coronal field is as permanently attached to the sun as our own magnetic system is attached to the earth. The solar coronal poles and equator are analogous to the earth's magnetic poles and magnetic equator. Any influence that passes from the sun to the earth in straight lines through the mediation of the ether of space is considered to belong to the radiant field. Any other influence that proceeds along the coronal lines belongs to the coronal field, and if it reaches the earth and affects our atmosphere it is said to be superposed upon the radiant field. According to Professor Bigelow the solar corona and the coronal field revolve about the sun's axis and the synodic revolution is completed in 26.68 mean solar days; he finds the same period in terrestrial magnetic

phenomena, so that a cycle of magnetic changes completes itself in this interval. It matters not whether these magnetic conditions and disturbances are caused by the changes produced in the earth's atmosphere by the sun and moon, or whether the sun and moon have a direct influence on the magnetic condition, it suffices for the present to recognize that the phenomena are sensibly synchronous with each other, and that the study of both together promises to elucidate laws that have hitherto been obscure. According to the remarkable memoir by Balfour Stewart (see *Encyclopædia Britannica*, article *Meteorology*, p. 184) "it would seem that terrestrial meteorology and terrestrial magnetism are probably cognate subjects, and that they ought to be studied together in the well-founded hope that the phenomena of the one will help us to explain those of the other."

As the subject of atmospheric electricity, including that of auroras and earth currents, has a small section in this REVIEW, the Editor takes pleasure in introducing a new section on terrestrial magnetism. The following text, together with Chart VI, will present from month to month a small part of the work being done by the Weather Bureau in this direction.

THE COMPARISON OF TEMPERATURE WITH MAGNETIC HORIZONTAL FORCE.

By Prof. F. H. BIGELOW.

In response to the request of the Chief of the Weather Bureau, the directors of the observatories at Toronto, Washington, and San Antonio have courteously undertaken to forward to the Bureau, as promptly as possible, certain data from their magnetograms, namely, the mean ordinates for the day from twenty-four hourly readings of the horizontal force, the declination, and the vertical force, uncorrected for instrumental errors and changes of temperature. On days exhibiting very disturbed magnetic conditions the hours and the values of the maximum and minimum ordinates are given.